Eugene, Oregon
Fleet Division & Fire Department
Internal Climate Action Plan

Prepared by Good Company
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The authors would like to acknowledge the following City of Eugene staff who developed this plan, offered review and guidance, and provided data for the assessment of potential actions.

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1. EXECUTIVE SUMMARY

Eugene's Climate Recovery Ordinance (CRO) requires that City operations reduce greenhouse gas emissions and are carbon neutral by 2020 – through a combination of internal actions and the purchase of verified carbon offsets – and to reduce use of fossil fuels by 50% by 2030 compared to 2010 usage. To plan for the requirements of the CRO, Eugene's Fleet Division and Fire Department have completed Internal Climate Action Plans, which have been combined into this single report.

To develop the plans, City management and staff identified potential greenhouse gas emissions (GHGs) reduction actions. These actions were either identified by staff or selected based on best management practices from peer organizations. The practices selected were assessed based on the total cost of ownership, GHG mitigation and fossil fuel reduction potential, operational feasibility, and other community co-benefits. The following actions were identified to be cost effective if the marginal action cost was equal to or less than voluntary market prices for verified carbon offsets (@$15 per metric ton of carbon dioxide equivalent).

Fleet Division
Action 1: Develop a CRO Fleet Purchasing Policy
Acton 2: Use Vehicle Telematics to Identify Fuel Conservation and Efficiency Opportunities
Action 3: Purchase Electric Vehicles and Develop Charging Infrastructure
Action 4: Renewable Diesel (R99) Substitution for Conventional Diesel
Fire Department
Action 1: Revise Fire Dispatch Protocols to Increase Fuel Efficiency
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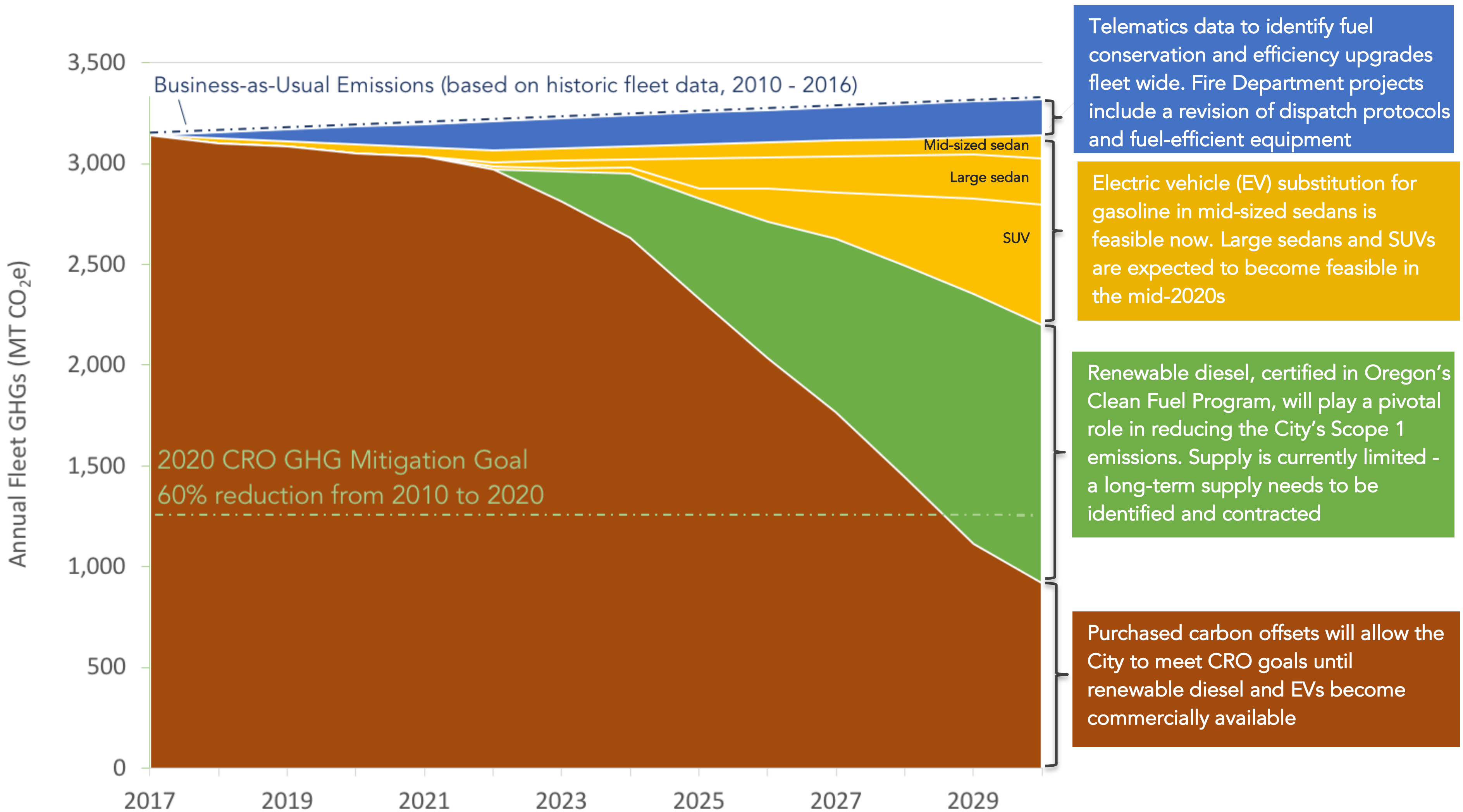
Figure ES-1 shows how these actions are projected to reduce the City's Fleet-related GHGs between 2018 and 2030. Reduction of GHGs comes from three main reduction strategies: 1) Fuel conservation and efficiency opportunities informed by telematics data, 2) Electrification of the City's gasoline powered fleet, 3) Renewable diesel substitution for conventional diesel fuel. Figure ES-2 shows how the actions are projected to reduce the City's use of fossil fuels.

Reaching CRO goals for internal action by 2020 for fleet is not possible without significant, unreasonable capital expense for technologies that have yet to mature. For example, electric vehicles are currently available, but battery range and model availability are still limited. By the mid-2020's electric vehicles are anticipated to be widely available and cost competitive with conventional technologies for many City applications. Similarly, renewable diesel offers great potential towards CRO goals, but production capacity in the US currently lags behind demand.

These issues are expected to be resolved by the mid-to-late 2020s allowing the City to meet CRO goals. In the meantime, the City can focus on identifying energy conservation and efficiency opportunities (with telematics) and continue to develop the City's electric vehicle infrastructure. For remaining unmitigated emissions, the City can purchase carbon offsets to achieve CRO goals.

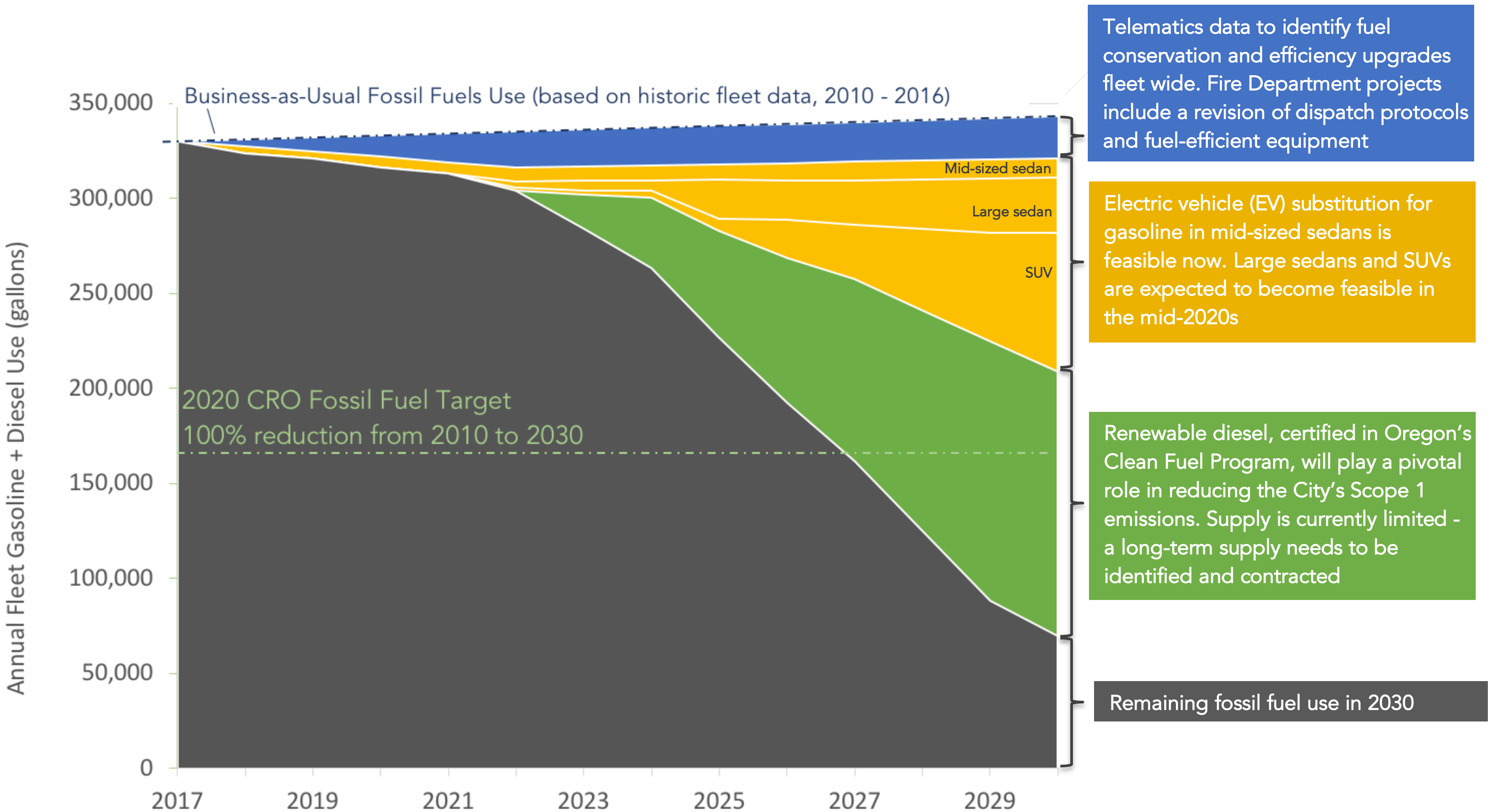
1.1. Estimated Timing Of GHG Reductions – For Cost-Effective Fleet Actions (Compared To Offsets @ $15 / 1 MT CO_2e)

Figure ES-1: Graphic predicting the City's GHG emissions (brown area) over time compared to CRO targets.



1.2. Estimated Timing of Fossil Fuel Reductions – For Cost-Effective Fleet Actions (Compared to Offsets @ $15 / 1 MT CO_2E)

Figure ES-2: Graphic predicting the City's fossil fuel use (dark gray area) over time compared to CRO targets.



2. INTRODUCTION

In 2014, the Eugene City Council passed Ordinance No. 20567, termed the Climate Recovery Ordinance (CRO). The CRO was revised in July 2016 to include specific targets and benchmarks related to the reduction of City of Eugene's operational greenhouse gas emissions (GHGs) and fossil fuel use.

To meet the requirements of the CRO, some City departments and divisions have developed climate action plans with the purpose of identifying GHGs and fossil fuel reduction actions and assessing those actions based on operational feasibility, financial cost or savings, GHG reduction potential, fossil fuel reduction potential, co-benefits, and cost effectiveness for reducing emissions ($ per reduction of one metric tonne of carbon dioxide equivalent (CO_2e)). This last metric, cost effectiveness of reduction, allows for comparison of different types of actions across all City departments and divisions so that the City may prioritize actions and compare costs to the market prices (assumed ($15/MT CO_2e) for the purchase of voluntary carbon offsets. This price comparison will be made within the context of operational feasibility and community co-benefits (jobs, enhanced service, other environmental benefits, etc.). This context could provide enough additional value to influence support for a higher priced mitigation action.

3. CLIMATE RECOVERY ORDINANCE – TARGETS & BENCHMARKS

Figure 1, from the 2016 amendment to the Climate Recovery Ordinance, summarizes the Targets & Benchmarks as related to City operations. Each Goal and Target is discussed in the following section based on the City's 2010 emissions.

Figure 1: Summary of Climate Recovery Ordinance Targets and Benchmarks.

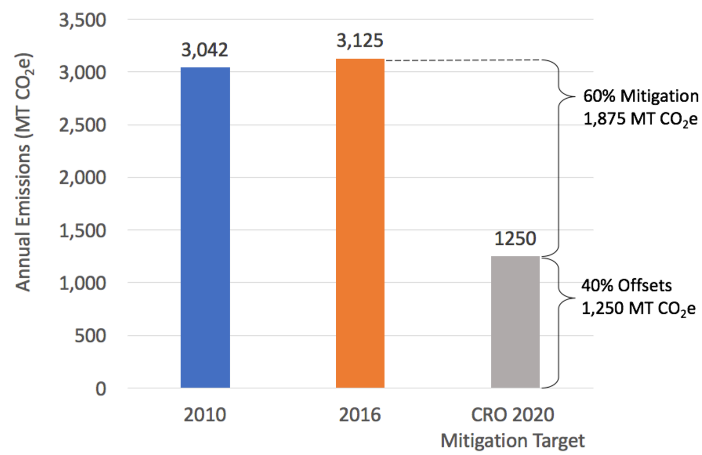
Goal	***Target (in GHGs)***	***Benchmark***
Carbon neutral operations	***60% reduction from 2010 levels by 2020***	***Annual: 15% reduction per year*** ***5 year: 60% reduction by 2020***
Reduce fossil fuels 50%	***50% reduction from 2010 levels by 2030.***	***Annual: 2.5% reduction per year*** ***By 2020: 25% reduction from 2010*** ***By 2025: 38% reduction from 2010*** ***By 2030: 50% reduction from 2010***

Note: The target for the Carbon Neutral Operations Goal in Figure 1 is focused on the 60% emissions reduction from internal mitigation projects portion of the goal. The goal also includes a target that is not explicitly summarized on this table – that the remaining 40% of the City's operational Scope 1 and Scope 2 emissions are to be mitigated in 2020 with the purchase of verified carbon offsets.

Target 1: Carbon Neutral Operations by 2020

Target 1 in the CRO applies to total City operations and does not specify department/division-level targets. The CRO allows for organizational flexibility to focus internal actions on the most cost-effective, internal mitigation opportunities regardless of department. For planning purposes, if the emissions target were applied equally to all departments, Fleet would be responsible for making the following reductions by 2020:

Figure 2: Target 1 – GHGs applied to City's gas and diesel use

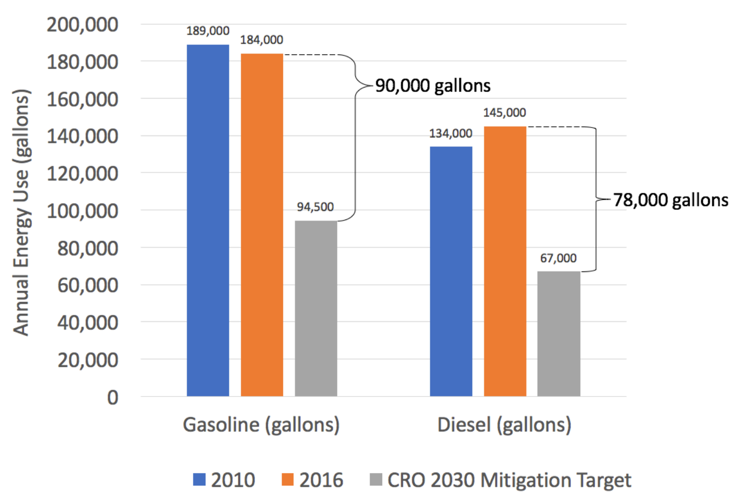


- 60% of 2010 emissions, or 1,867 MT CO_2e, are to be mitigated by internal actions. For a sense of scale, 1,800 MT CO_2e is roughly equivalent to Eugene's 2016 emissions from gasoline use.
- 40% of 2010 emissions, or 1,244 MT CO_2e, may be mitigated through the purchase of verified carbon offsets, per the CRO. Using a carbon offset price of $15 / MT CO_2e, the annual cost of offsets for 40% of 2010 emissions equals roughly $19,000. The cost of offsetting 100% of 2016 emissions is roughly $47,000 annually.

Target 2: Reduce Fossil Fuels 50% by 2030

- Gasoline use will require 90,000 gallon reductions by 2030, or annual reductions of 6,900 gallons over the next 13 years.
- Diesel use will require a 78,000 gallon reduction by 2030 or annual reductions of 6,000 gallons over the next 13 years.
- Natural gas use in buildings, including fleet facilities, will be addressed in the City's Facility Climate Action Plan.

Figure 3: Target 2 applied to City's gas and diesel use.
Note: Figure shows fossil fuel volume only. The values do not include the biofuels that are blended with gasoline and diesel under Oregon's Renewable Fuel Standard.



4. 2016 FLEET ENERGY AND EMISSIONS SUMMARY

In 2016, the City's fleet consumed 382,000 gallons of fossil fuel blended with biofuels and emitted 3,125 MT CO_2e[1]. The City's fleet is made up of a variety of vehicles and equipment that have recently fueled with gasoline blended with ethanol (E10) and diesel blended with biodiesel (B20). Figure 4 summarizes emissions, by department. Within City operations, the largest consumers of fleet fuels include Public Works, Police, and Fire. Figure 6 shows that Police and Public Works are the largest gasoline consumers and Figure 7 shows Public Works and Fire are the largest diesel consumers. Figure 5 shows that in 2016 about 15% of all fuel consumed by the City were lower-carbon biofuels.

Figure 4: Fleet-related GHGs by department

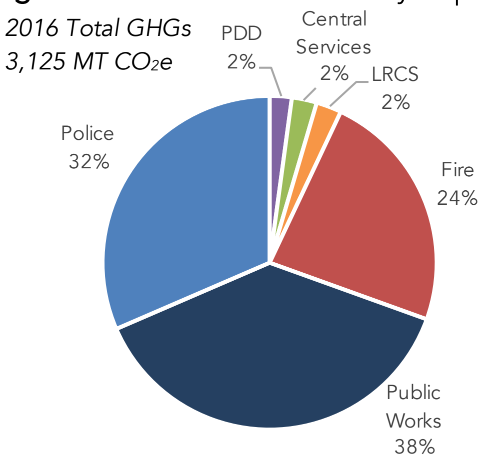


Figure 5: Fuel use by type (gallons)

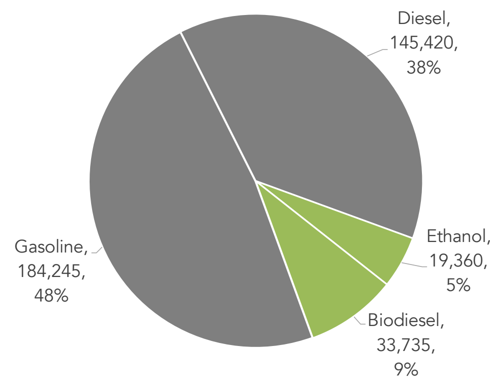


Figure 6: Gasoline use by department (gallons)

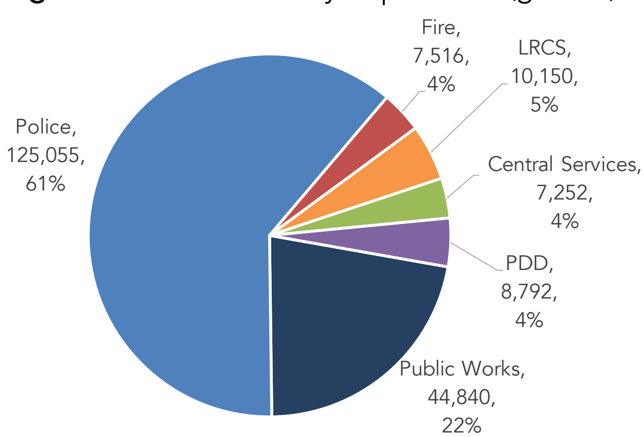
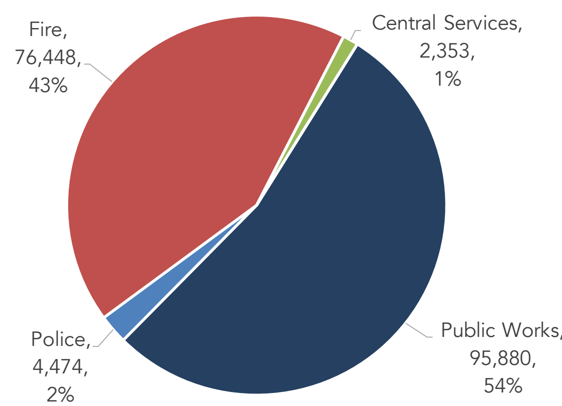


Figure 7: Diesel use by department (gallons)



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[1] Fleet's 2016 biogenic emissions from fleet fuel total 430 MT CO2e in 2016, which per protocol, are reported separately from fossil fuel emissions. It is also important to note that the City's current accounting does not include Scope 3 emissions from fleet fuels, which are upstream, embodied emissions that are created during production of fleet fuels. These upstream emissions, while not required to report on in voluntary GHG inventory protocols, should be considered when selecting alternative fuels and can vary from very low to very high GHG effects, despite being bio sourced. See Action 7 for details.

5. DESCRIPTION OF FLEET / FIRE CRO PLANNING PROCESS

The Fleet and Fire internal climate action plan (ICAP) planning processes were a collaborative effort between City of Eugene and Good Company. City staff provided guidance and decision-making and Good Company supported the process through facilitated meetings, best management practice research, and analysis of potential actions. An identical, parallel process was used by the Fleet division and the Fire department to develop this plan.

Review of Best Management Practices

Good Company reviewed municipal fleet climate action plans and related documents to summarize the best management practices (BMPs) being used around the U.S. to manage fleet fuel use and emissions. The intent of this research was to identify potential actions with: (1) significant mitigation potential, (2) commercial availability; (3) successful implementation in a municipal fleet, and (4) offer community co-benefits (e.g., air quality, local jobs).

BMP Review and Staff Discussion

Fleet management and staff reviewed and discussed the BMPs for opportunities and risks and applicability based on local context. Staff identified the actions for further assessment, shown in Figure 8 (page 11) and Figure 9 (page 16). The actions were assessed (as described below) and the results were presented to Fleet management and staff for consideration as the Fleet ICAP was finalized.

Assessment and Comparison of Potential Actions

The City's 2016 fuel data was combined with findings from the BMP research to model GHG and fossil fuel reductions. City staff information and Good Company research were used to estimate capital, operation, maintenance costs, operational feasibility, and co-benefits. Emissions reductions and cost information were used to calculate cost-effectiveness for CRO emissions reduction, or $ per metric ton of carbon dioxide equivalent reduced. A summary of findings is shown on Figure 8 and Figure 9.

Development of the Final Fleet & Fire Climate Action Plan

Those actions found to be cost-effective compared to the purchase of a carbon offset at $15 per metric tonne of carbon dioxide equivalent are included in the Fleet & Fire Climate Action Plan Recommendations for further evaluation or implementation.

6. FLEET DIVISION – SUMMARY CLIMATE ACTION PLAN PROCESS AND FINDINGS

6.1 Fleet Division Climate Actions *Identified and Analyzed* in the Planning Process

Develop CRO Fleet Purchasing Policy

Existing Conditions: Currently the City does not have a formal vehicle and equipment purchasing policy.

Action Description: Developing and implementing a city-wide purchasing policy is a foundational action that has been taken by many municipal governments, to ensure that the most efficient, lowest lifecycle cost and carbon vehicles and equipment are purchased for the service need, with appropriate exemptions for emergency vehicles.

Use Vehicle Telematics to Identify Fuel Conservation Opportunities

Existing Conditions: The City currently uses automatic vehicle location (AVL) systems on about 100 vehicles and is experimenting with telematics. AVL systems provide the location of vehicles in real time, while telematics collects additional information on vehicle operation and performance. To date these systems have not been used rigorously to manage vehicle operation for fuel conservation.

Action Description: Telematics refers to equipment that allows collection of vehicle operational data – such as fuel use, maintenance, utilization, idling, location, routing or mapping of trips, emissions, braking patterns and speed. Fleet will install approximately 100 telematics units on the vehicles / equipment with the greatest potential opportunities for fuel conservation or operational co-benefits and provide supervisors with training on how to use the information system. The data will also be reviewed by Fleet Board to regularly revise the CRO Fleet Purchasing Policy and management practices.

Purchase Electric Vehicles and Develop Charging Infrastructure

Existing Conditions: The City currently has roughly 450 vehicles and equipment that annually use 240,000 gallons of gasoline (E10). The fleet currently includes 7 electric vehicles, both battery electric vehicles and plug-in hybrid electric vehicles. The City to date has also installed 9 EV chargers to support the fleet's conversion to electricity from gasoline.

Action Description: Electric vehicles are substituted for gasoline vehicles as soon as technologically and financially viable. The City will continue developing charging infrastructure at City facilities.

Renewable Diesel (R99) Substitution for Conventional Diesel

Existing Conditions: The City currently has roughly 250 vehicles and equipment that annually use 150,000 gallons of diesel (R20). The City currently uses an R20 diesel fuel blend (20% renewable diesel and 80% fossil diesel fuel).

Action Description: The City will work with local and regional partners to identify and secure additional supply of low carbon 99% blend of renewable diesel (R99) as soon as possible to substitute for 100% of the City's current diesel use. The R99 will be certified as a low-carbon fuel in Oregon's Clean Fuels Program.

Propane Dual-Fuel Vehicle Conversions and Develop Fueling Infrastructure

Existing Conditions: In 2016, Eugene Police Department had 53 vehicles that used 95,000 gallons of gasoline (E10).

Action Description: Install dual-fuel propane conversion kits on police patrol vehicles and develop propane fueling infrastructure at the County Club Road facility.

Compressed Natural Gas Vehicles Conversions and Develop Fueling Infrastructure

Existing Conditions: The City currently has roughly 390 vehicles and equipment that annually use 250,000 gallons of gasoline (E10) and diesel (B20) that have market-ready, compressed natural gas (CNG) vehicle alternatives.

Action Description: Install CNG conversion kits on 390 standard pickups, SUVs, vans, class 4 – 8 trucks, buses, and street sweepers and develop fueling infrastructure at Roosevelt facility.

6.2 COMPARISON OF POTENTIAL FLEET ACTIONS – SUMMARY OF COST AND CRO REDUCTIONS

Figure 8: Summary of action assessment findings (note: a number with parentheses (x) indicates a *benefit* of savings for cost, fuel, and emissions).

Action Description	Marginal Capital Cost ($ / action)	Marginal Operating Savings or Cost ($ / year 1)	Action Lifespan (years)	Annual Fossil Fuel Reduction (gallons)	Annual GHG Reduction (MT CO_2e)[3]	Cost Effectiveness ($ / -1 MT CO_2e)	Timing of Implementation year	Operational Feasibility	Co-Benefits
Develop CRO Fleet Purchasing Policy	Development of a purchasing policy is a prerequisite for all other action and therefore is not scaled						2018	• Policy adoption will create written document that captures existing practice • Policy will require users to consider climate action plan and put formal process in place for alternative equipment that may not meet requirement	• Will provide educational opportunities for all staff involved with equipment specifications about alternative vehicles and energy sources
Use Vehicle Telematics to Identify Fuel Conservation Opportunities							2018 - 2030	• Installation can easily be integrated into work flow • System administration, support and training of system users may require some additional FTE • Minor initial capital cost for each vehicle can be implemented over time to limit large, one-time expense to users	• Maintenance is performed based on equipment performance to reduce breakdowns • Maximize vehicle and equipment utilization
With 5% annual fuel conservation	$30,000	$1,100	5	(9,150)	(156)	$226			
With 10% annual fuel conservation	$30,000	($21,800)	5	(18,300)	**(312)**	($236)			
Purchase Electric Vehicles and Develop Charging Infrastructure								• Reduced maintenance for electric vehicles • Light-Duty EVs, other than mid-sized, expected to be cost and range competitive by 2025 • Significant additional infrastructure is required for EV charging (included in costs) • Electric grid connections may need upgrades (included in costs)	• Reduces urban criteria air pollutants • Coupled with City-owned PV solar EV would provide resilience against in emergencies
Mid-sized sedan[1] (with Federal + State Tax Credit)	*$68,000*	*($20,043)*	*10*	*(9,514)*	*(78)*	*($205)*	2018 - 2025		
Mid-sized sedan[1] (with Federal Tax Credit)	*$238,000*	*($20,043)*	*10*	*(9,514)*	*(78)*	*$13*			
Mid-sized sedan[1] (with State Tax Credit)	*$578,000*	*($20,043)*	*10*	*(9,514)*	*(78)*	*$450*			
Mid-sized sedan[1] (without any Tax Credit)	*$748,000*	*($20,043)*	*10*	*(9,514)*	*(78)*	*$668*			
Large sedan[2]	*$342,000*	*($73,057)*	*5*	*(27,585)*	*(224)*	*($58)*	2025 - 2030		
SUV[2]	*$1,160,000*	*($196,101)*	*5 - 10*	*(77,842)*	*(631)*	*($39)*	2025 - 2030		
Van[2]	*$912,000*	*($62,392)*	*10*	*(21,868)*	*(178)*	*$130*	2025 - 2030		
Standard Pickup[2]	*$900,000*	*($70,048)*	*10*	*(24,811)*	*(202)*	*$68*	2025 - 2030		
Renewable Diesel (R99) Substitution for Conventional Diesel							2017 - 2030	• Renewable diesel is a "drop-in" fuel replacement and does not require new equipment, fueling infrastructure, or maintenance practices • Limited US refining capacity and supply	• If refinement capacity were locally available, renewable diesel could be produced with locally available feedstocks, such as waste grease
At $0.05 per gallon premium	$0	$9,288	1	(143,540)	(1,480)	$6			
At $0.10 per gallon premium	$0	$18,576	1	(143,540)	(1,480)	$13			
At $0.20 per gallon premium	$0	$37,153	1	(143,540)	(1,480)	$25			
At $0.40 per gallon premium	$0	$74,306	1	(143,540)	(1,480)	$50			
At $0.60 per gallon premium	$0	$111,459	1	(143,540)	(1,480)	$75			
Propane Dual-Fuel Vehicle Conversions and Develop Fueling Infrastructure	$458,000	$49,098	5 - 10	9,292	9	Not calculated	*TBD*	• New fueling infrastructure will be required at Country Club Rd. facility • Propane fuel costs vary and may be more or less than E10 gasoline over time	• Extended range for patrol vehicles • Fuel options during emergencies
Compressed Natural Gas Vehicles Conversions and Develop Fueling Infrastructure								• Fleet facilities would require upgrades to maintenance equipment and fueling infrastructure	• CNG vehicle and infrastructure may also use renewable CNG from biogas, a locally produced, low-carbon fuel
Fossil Compressed Natural Gas	*$7,545,000*	*($89,088)*	*15*	*210,248*	*(182)*	*$2,334*	TBD		
Renewable Compressed Wastewater Gas	*$7,545,000*	*($89,088)*	*15*	*210,248*	*(1,900)*	*$223*	TBD		

Note 1: 100% conversion by 2030, current prices
Note 2: 100% conversion by 2030, projected 2025 prices
Note 3: Metric tons of carbon dioxide equivalent (MT CO_2e)
Note 4: Capital and O&M Costs on the table represent marginal costs compared to business as usual baseline.
Note 5: 100% conversion of SUVs, Standard Pickup Trucks, Street Sweepers, Class 4 - 8 Trucks, Vans, and Buses

6.3 Summary of Recommended cost-effective fleet actions (Compared to offsets@$15)

Action 1: Develop CRO Fleet Purchasing Policy

Developing and implementing a city-wide purchasing policy is a foundational action that has been taken by many municipal governments, to ensure that the most efficient, lowest lifecycle -cost and -carbon vehicles and equipment are purchased for the service need, with appropriate exemptions for emergency vehicles. This policy will be developed by the City's Fleet Board with support from Fleet department staff by reviewing existing policy from respected peer organizations' policies as a starting point. The Fleet Purchasing Policy will provide the authority and guidance needed to implement the other actions.

Action 2: Use Vehicle Telematics to Identify Fuel Conservation Opportunities

Telematics refers to equipment that allows collection of vehicle operational data – such as fuel use, maintenance, utilization, idling, location, routing or mapping of trips, emissions, braking patterns and speed. This data helps fleet managers identify opportunities to reduce fleet size, fuel use, unnecessary maintenance and implement opportunities to right-size vehicles and conduct driver training to reduce fleet costs. Data collected by telematics will support decision-making for other efficiency and conservation projects.

Action 3: Purchase Electric Vehicles and Develop Charging Infrastructure

Electric vehicles and charging infrastructure, combined with electricity from renewable and other low-carbon generation sources, is the City's largest opportunity to significantly increase vehicle and equipment energy efficiency and substitute a low-carbon fuel for gasoline. Electric vehicle technology is market-ready and cost competitive for the mid-sized sedans. Similar circumstances for the rest of the light-vehicle market are predicted by many to arrive by 2025. Therefore, the City will plan for conversion of all the City's owned mid-sized and large sedans and SUV's as soon as possible – based on advances in battery technology and costs. Depending on the timing and need for the vehicle purchase, hybrid electric vehicles (HEV) or plug in HEVs (PHEV) may also be considered for pick-up trucks and vans.

Action 4: Renewable Diesel (R99) Substitution for Conventional Diesel

Renewable diesel offers the potential to almost fully replace conventional diesel fossil fuel with a fuel made from low-carbon, plant-based feedstocks that are certified in Oregon's Clean Fuels Program. Specifying ODEQ certified, lower-carbon fuels is essential to avoid purchasing fuels with lifecycle emissions greater than conventional B5 diesel fuel. The near-term barrier to this action is limited renewable diesel refinement capacity domestically and therefore limited available supply. The City will work with local and regional partners to identify and secure additional supply of low carbon 99% blend of renewable diesel (R99) as soon as possible. The City currently uses an R20 diesel fuel blend (20% renewable diesel and 80% fossil diesel fuel).

6.4 Fleet Division Climact Action Plan – Description of Action Subtasks and Timing

2018 – 2020 Actions

- Fleet Action 1: Develop and Implement Purchasing Policy
  - *Action 1.1: Review Existing Policies from Peer Agencies*
  - *Action 1.2: Draft Eugene Fleet Purchasing Policy*
  - *Action 1.3: Fleet Policy Review by Fleet Board*
  - *Action 1.4: Policy Adoption by Fleet Board and City Executives*
- Fleet Action 2: Fuel Conservation, Efficiency, and Telematics Data Collection
  - *Action 2.1: Install Telematics on Vehicles / Equipment*
  - *Action 2.2: Supervisors Review Data and Identify Opportunities*
  - *Action 2.3: Fleet Board Review and Implementation of Opportunities*
- Fleet Action 3: Electric Vehicles and Charging Infrastructure
  - *Action 3.1: Purchase Mid-Sized EVs on Existing Replacement Schedule*
  - *Action 3.2: Continue to develop EV Chargers and Related Infrastructure*
- Fleet Action 4: Renewable Diesel
  - *Action 4.1: Continue Purchase of R20 renewable diesel blend*
    - *Action 4.1.1: Request R20 Lifecycle Carbon Intensity from Vendors*
  - *Action 4.2: Continue Strategic Partnerships to Source R99*

2020 – 2025 Actions

- Fleet Action 1: Develop and Implement Purchasing Policy
  - *Action 1.1: Review and Update Purchasing Policy as Needed*
- Fleet Action 2: Fuel Conservation, Efficiency, and Telematics Data Collection
  - *Action 2.1: Review Progress and Revise Action 2*
- Fleet Action 3: Electric Vehicles and Charging Infrastructure
  - *Action 3.1: Substitute Mid-Sized, Large, and SUV EVs for Gasoline Vehicles on Existing Replacement Schedule*
  - *Action 3.2: Continue to develop EV Chargers and Related Infrastructure*
  - *Action 3.3: Review EV Market Conditions and Adjust Plan as Needed*
- Fleet Action 4: Renewable Diesel (R99) Substitution for Conventional Diesel
  - *Action 4.1: Continue Strategic Partnerships to Source R99 as soon as available*

2025 – 2030 Actions

- Fleet Action 1: Develop and Implement Purchasing Policy
  - *Action 1.1: Review and Update Purchasing Policy as Needed*
- Fleet Action 2: Fuel Conservation, Efficiency, and Telematics Data Collection
  - *Action 2.1: Review Progress and Revise Action 2 as Needed*
- Fleet Action 3: Electric Vehicles and Charging Infrastructure
  - *Action 3.1: Substitute Mid-Sized, Large, and SUV EVs for Gasoline Vehicles on Existing Replacement Schedule*
  - *Action 3.2: Continue to develop EV Chargers and Related Infrastructure*
  - *Action 3.3: Review EV Market Conditions and Adjust Plan as Needed*
- Fleet Action 4: Renewable Diesel (R99) Substitution for Conventional Diesel
  - *Action 4.1: Continue Strategic Partnerships to Source R99 as soon as available*

7. FIRE DEPARTMENT – SUMMARY CLIMATE ACTION PLAN PROCESS AND FINDINGS

7.1 Fire Department Climate Actions *Identified and Analyzed* in the Planning Process

Revise Fire Dispatch Protocols to Increase Fuel Efficiency

Existing Conditions: Eugene Fire Department's (EFD) current dispatch protocols require that specific vehicles and staff respond to specific types of emergency calls.

Action Description: For an estimated 20% of EFD's calls, about 6,000 calls per year, could be made using smaller vehicles with fuel efficiency 2.5 times existing conditions. New, smaller response vehicles would need to be purchased to respond to these calls.

Efficient Fire Vehicle Fueling Infrastructure

Existing Conditions: EFD vehicles currently refuel at the City's Roosevelt facility.

Action Description: Stations 1, 13, and 15 to refuel at a geographically, closer private fueling station.

Install Auxiliary Power Units (APU) on Engines and Medical Units

Existing Conditions: EFD's current vehicle and equipment stock. In 2016, these vehicles used about 30,000 gallons of diesel (R20).

Action Description: Further evaluate cost-effective APU opportunities[2] for fire engines and medical units and install units, as appropriate.

Electric Engine Demonstration Project

Existing Conditions: EFD current vehicle and equipment stock. In 2016, EPD engines used on average 2,000 gallons of diesel (R20) fuel.

Action Description: Substitute a battery electric motor for one of two diesel-powered motors on an existing EFD fire engine. One of the two engines would be electrified and used when possible to increase fuel efficiency. An example of use would be the return trip to the fire station after a call.

Renewable Diesel (R99) Substitution for Conventional Diesel

Existing Conditions: In 2016, EFD had 73 vehicles that used 78,400 gallons of diesel (R20).

Action Description: The City's Fleet Division and EFD will work with local and regional partners to identify and secure additional supply of low carbon 99% blend of renewable diesel (R99) as soon as possible to substitute for 100% of EFD's current diesel (R20) use. The R99 will be certified as a low-carbon fuel in Oregon's Clean Fuels Program.

Use Simulator for Code 3 Driver Training

Existing Conditions: Currently Code 3 driver training is conducted using a fire engine. This training is estimated to use 4,100 gallons of diesel (R20) fuel annually.

Action Description: A portion of Code 3 driver training would be substituted with training in a simulator.

Substitute Electric Pump during Hose Training

Existing Conditions: Fire pumper trucks are currently used for hose training. This training is estimated to use approximately 7,000 gallons of diesel (R20) fuel annually.

Action Description: A new, electric pump would be substituted for a diesel pump during hose training.

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[2] City's vehicles and equipment such as bucket trucks, sewer-line maintenance trucks, wood chippers, police cars, fire trucks, and ambulances require equipment which diverts power from the main vehicle engine to power service equipment. At times, the vehicle's engine is oversized for the power requirements and therefore serves as an inefficient way to supply the power. In these situations, APUs provide a more efficient means of providing power.

Upgrade Fire Engine (Quint) for Efficient Model

Existing Conditions: EFD currently owns two (2) Quint fire engines. These engines use a combined 6,500 gallons of diesel (R20) fuel annually, or about 3,250 gallons per Quint.

Action Description: A new, more efficient Quint model is purchased and the existing Quint is sold on the used equipment market. Recent model year Quint fire engines are expected to roughly double the fuel efficiency of models currently owned by the City.

7.2 COMPARISON OF POTENTIAL FIRE DEPT. ACTIONS – SUMMARY OF COST AND CRO REDUCTIONS

Figure 9: Summary of action assessment findings (note: a number with parentheses (X) indicates a *benefit* of savings for cost, fuel, and emissions).

Action Description	Marginal Capital Cost ($ / action)	Marginal Operating Savings or Cost ($ / year 1)	Action Lifespan (years)	Annual Fossil Fuel Reduction (gallons)	Annual GHG Reduction (MT CO_2e)[3]	Cost Effectiveness ($ / -1 MT CO_2e)	Timing of Implementation year	Operational Feasibility	Co-Benefits
Revise Fire Dispatch Protocols to Increase Fuel Efficiency	$200,000	(20,485)	10	(6,269)	(80)	$12	2018 - 2020	• Requires change in dispatch protocols and updates to the Computer Aided Dispatch program • COE staff have ability to make changes	• Reduced engine maintenance and costs • Reduced urban criteria air pollutants • Increased crew availability for other calls
Efficient Equipment Fueling Infrastructure									
Retail fueling for Stations 1, 13, 15	$0	$4,598	1	(326)	(4)	$1,072	TBD	• Infrastructure is already in place • Can be quickly implemented	• Reduced engine maintenance and costs • Reduced urban criteria air pollutants • Increased crew availability for other calls
Install Auxiliary Power Units (APU) on Engines and Medical Units									
Engines - With 5% Fuel Savings	$66,000	($1,368)	20	(408)	(4)	$495	2018 - 2020	• Require major retrofit on current apparatus • Can be ordered and included on new, replacement apparatus	• Reduced engine maintenance and associated costs • Reduced urban criteria air pollutants
Engines - With 10% Fuel Savings	$66,000	($2,735)	20	(816)	(8)	$104			
Medic Units - With 5% Fuel Savings	$48,000	($2,763)	10	(863)	(9)	$250			
Medic Units - With 10 % Fuel Savings	$48,000	($5,525)	10	(1,726)	(18)	($19)			
Electric Engine Demonstration Project									
With 10% Fuel Savings	*$67,000*	*($515)*	*10*	*(160)*	***(2)***	*$3,839*	TBD	• Demonstration project with unproven technology for the application • EFD staff has the technical and mechanical skills to engineer the conversion	• If successful, the project would be the first known EV fire truck in the US
With 25% Fuel Savings	*$67,000*	*($1,300)*	*10*	*(400)*	***(4)***	*$1,387*			
With 40% Fuel Savings	*$67,000*	*($2,100)*	*10*	*(640)*	***(7)***	*$774*			
Renewable Diesel (R99) Substitution for Conventional Diesel									
At $0.05 per gallon premium	$0	$4,066	1	(62,062)	(648)	$6	2016 - 2030	• Renewable diesel is a "drop-in" fuel replacement and does not require new equipment, fueling infrastructure, or maintenance practices • Limited US refining capacity and supply	• If refinement capacity were locally available, renewable diesel could be produced with locally available feedstocks, such as waste grease
At $0.10 per gallon premium	$0	$8,132	1	(62,062)	(648)	$13			
At $0.20 per gallon premium	$0	$16,265	1	(62,062)	(648)	$25			
Use Simulator for Code 3 Driver Training	$0	($11,040)	1	4,118	(34)	($315)	2018 - 2030	• Already in use by EFD and proven operationally effective	• Reduced engine maintenance and associated costs • Reduced urban criteria air pollutants
Upgrade Fire Engine (Quint) for Efficient Model	$630,000	($7,825)	20	(3,225)	(27)	$1,052	TBD	• Existing equipment is not due to be replaced. This upgrade is outside the EFD's replacement schedule	• Reduced urban criteria air pollutants
Substitute Electric for Diesel Pump during Hose Training	$50,000	($6,213)	10	(336)	(3)	($237)	2018 -2030	• Pump will need to be mobile and location of power sources will need to be considered	• Reduced engine maintenance and associated costs • Reduced urban criteria air pollutants generally and specifically for trainees

Fire Action 1: Revise Fire Dispatch Protocols to Increase Fuel Efficiency

Eugene Fire Department is currently in a facilitated process to discuss, plan, and implement dispatch protocol revisions. Dispatch protocols revisions are expected to be complete by 2020 and will likely roll out in 2 – 4 phases. The first phase is being implemented in January 2018. Two to four new vehicles with greater fuel efficiency will need to be purchased at a cost of approximately $200,000 to support this action. Once fully implemented, the revised dispatch protocols will result in 6,000 trips that will be made in vehicles with 2.5 times the current vehicle fuel efficiency.

Fire Action 2: Renewable Diesel (R99) Substitution for Conventional Diesel

As previously described, renewable diesel offers the potential to almost fully replace conventional diesel fossil fuel with a fuel made from low-carbon, plant-based feedstocks that are certified in Oregon's Clean Fuels Program. As is shown on Figure 6 and 7, diesel fuel represents the majority of EFD's fuel needs and therefore will substantially reduce Fire's Scope 1 GHG emissions.

Fire Action 3: Auxiliary Power Units on Medic Units

APUs were considered for engines and medic units. Based on EFD 2016 fuel usage; case studies of fuel reductions by peer organizations; and staff data and other research on equipment costs by it was found that the greatest opportunity for EFD is related to the medic units. Therefore, these units will be the initial focus of further evaluation and implementation as appropriate.

Fire Action 4: Use Simulator for Code 3 Driver Training

EFD already owns the training simulator equipment. This equipment will be used to avoid diesel use and related emissions to the greatest degree possible, while maintaining training quality standards.

Fire Action 5: Substitute Electric for Diesel Pump during Hose Training

EFD would need to purchase a new electric pump that meets operational and training requirements. This equipment will be used to avoid diesel use to the greatest degree possible, while maintaining training quality and standards.

2018 – 2020 Actions

- Fire Action 1: Revise Fire Dispatch Protocols to Increase Fuel Efficiency
    - *Action 1.1: Continue facilitated development process to revise dispatch protocols*
    - *Action 1.2: Purchase vehicles and equipment for Phase 1 implementation*
    - *Action 1.3: Implement Phase 1 of revised dispatch protocols*
    - *Action 1.4: Purchase vehicles and equipment for Phase 2 implementation*
    - *Action 1.5: Implement Phase 2 of revised dispatch protocols*
- Fire Action 2: Renewable Diesel (R99) Substitution for Conventional Diesel
    - *Action 2.1: Continue purchasing R20 renewable diesel blend. Verify lifecycle carbon intensity.*
    - *Action 2.2: Continue Strategic Partnerships to Source R99 as soon as supply is available*
- Fire Action 3: Auxiliary Power Units (APUs) on Medic Units
    - *Action 3.1: Use telematics data to evaluate APU opportunity on Medic Units*
    - *Action 3.2: Install APUs on medic units, as appropriate*
- Fire Action 4: Use Simulator for Code 3 Driver Training
    - *Action 4.1: Substitute Code 3 simulator training*

2020 – 2025 Actions

- Review Fire ICAP progress and update plan as needed
- Fire Action 1: Revise Fire Dispatch Protocols to Increase Fuel Efficiency
    - *Action 1.1: Review and Update Protocols as Needed*
- Fire Action 2: Renewable Diesel (R99) Substitution for Conventional Diesel
    - *Action 2.1:* Continue purchasing R20 renewable diesel blend
    - Action 2.2: Continue Strategic Partnerships to Source R99 as soon as supply is available
- Fire Action 3: Auxiliary Power Units (APUs) on Medic Units
    - *Action 3.1: Review APU Performance and Update Use Appropriately*
- Fire Action 4: Use Simulator for Code 3 Driver Training
    - *Action 4.1: Continue to Substitute Simulator as appropriate*

2025 – 2030 Actions

- Review Fire ICAP progress and update plan as needed
- Fire Action 1: Revise Fire Dispatch Protocols to Increase Fuel Efficiency
    - *Action 1.1: Review and Update Protocols as Needed*
- Fire Action 2: Renewable Diesel (R99) Substitution for Conventional Diesel
    - *Action 2.2: Continue Strategic Partnerships to Source R99 as soon as supply is available*

APPENDIX A: SUMMARY OF FLEET DIVISION ASSUMPTIONS USED FOR COST AND CRO REDUCTION CALCULATIONS

Action Description	Cost and CRO Reduction Assumptions used in Calculations
Action 1: Purchasing Policy	Development of a purchasing policy is a prerequisite for all other action and therefore is not scaled
Action 2: Vehicle Telematics	*• Installation of telematics will reduce overall fuel consumption by 5 - 20% per vendor information and available case studies. Note: It is difficult to predict fuel and maintenance savings prior to telematics data collection; identification of opportunity; and management for continuous improvement. Therefore tiers are used to show the range of potential.* *• Telematics equipment and installation for 250 units @ $300 per unit* *• Monthly telematics subscription fee for 250 units @ $20 per month* *• Annual fuel savings based on Eugene's 2016 fuel costs* *• Scope 1 and Scope 3 fuel emissions factors from Argonne National Lab's AFLEET tool*
Action 3: On-Board Power Supplies	Assessment of on-board power supplies to be based on specific opportunities identified with telematics
Action 4: Battery Electric Vehicles and Chargers	*• Baseline fuel type is 90% gasoline and 10% ethanol (Oregon E10)* *• Alternative fuel type is assumed to be 100% EWEB retail electricity* *• EV uses 30 kWh per 100 miles* *• Mid-sized sedan internal combustion engine (ICE) new vehicle cost of $24,000, based on 2017 Ford Focus Hybrid* *• Mid-sized sedan battery electric vehicle (BEV) cost of $30,000, based on 2017 Ford Focus EV* *• Mid-sized sedan Federal tax credit of $7,500 and Oregon state tax credit of $2,500.* *• Large sedan BEV premium of $7,000 in 2025* *• Large sedan SUV premium of $7,000 in 2025* *• BEV maintenance cost of $0.125 / mile* *• Gasoline ICE maintenance cost of $0.137 / mile*
Action 5: Renewable Diesel (100% R99 substitution for diesel)	*• Renewable diesel prices calculated based on $0.05, $0.10, $0.20, $0.40, and $0.60 per gallon premiums over conventional diesel (B5)* *• Fuel heat contents and Scope 1 emissions factors from Argonne's AFLEET tool*
Action 6: Propane and Fueling Infrastructure at Eugene Police Department	*• Fuel station cost of $130,000. Enough to serve 65 police cruisers at 7 gallons per day* *• Assumes 0 tax credit for capital costs* *• Vehicle conversion for 65 units @ $6,000 per vehicle conversion costs* *• Assumes equal costs for vehicle maintenance per Argonne Lab's AFLEET tool* *• Year 1 propane average cost is $2.83 per gallon per US DOE data* *• Year 1 E10 average cost is $2.58 per gallon per US DOE data*
Action 7: Compressed Natural Gas Vehicles and Infrastructure	This action should be assessed prior to fleet facility upgrades

APPENDIX B: SUMMARY OF FIRE DEPT. ASSUMPTIONS USED FOR COST AND CRO REDUCTION CALCULATIONS

Action Description	Cost and CRO Reduction Assumptions used in Calculations
Revise Fire Dispatch Protocols to Increase Fuel Efficiency	• Annual EFD trips total 36,000 per year • 6,000 trips per year could be performed by lighter duty vehicles • Baseline fuel efficinecy is 4 miles per gallon • Action fuel efficiency is 10 miles per gallon • Capital costs for new, lighter duty vehicles totals $200,000 • Fuels cost are based on 2016 prices and annual costs • Baseline fuel type is B20 diesel fuel • Action fuel type is B20 diesel fuel
Efficient Equipment Fueling Infrastructure	• *Annual EFD trips from stations 1, 13, and 15 total 1,102 per year* • *Capital costs are $0* • *Marginal fuel costs are $0.40 / gallon* • *Fuels cost are based on 2016 prices and annual costs* • *Baseline fuel type is B20 diesel fuel* • *Action fuel type is B20 diesel fuel* • *Distances between stations and City fueling were calcualted with GIS* • *Distances between stations and retail fueling were calcualted with GIS*
Install Auxiliary Power Units (APU) on Engines and Medical Ur	• Assessment includes 3 top fuel using engines that used 10,200 gallons of B20 in 2016 • 5-10% fuel savings from installation of APUs, per review of peer fleet case studies • Based on 2016 B20 fuel costs for engines • Capital costs are $22,000 for a total cost of $66,000 for 3 engines. The range of costs in literature ranted from $15,000 to $30,000. Value used was mid range. • Fuels cost are based on 2016 prices and annual costs • Baseline fuel type is B20 diesel fuel • Action fuel type is B20 diesel fuel
Electric Engine Demonstration Project	• *Baseline fuel type is assumed to be 90% gasoline and 10% ethanol* • *Alternative fuel type is assumed to be 100% EWEB retail electricity* • *EV uses 2.8 kWh per 1 mile* • *Federal tax credit of $7,500* • *BEV maintanance cost of $0.125 / mile* • *Gasoline ICE maintanance cost of $0.137 / mile* • *Average engine consumes 2,000 gallons of diesel per year* • *Battery cost of $450 per kWh for a 100 kWh battery = $45,000* • *Electric motor cost of $8,500* • *Cost for power electronics of $11,000* • *Engineering and installation cost of $10,000*

APPENDIX B: SUMMARY OF FIRE DEPT. ASSUMPTIONS USED FOR CALCULATIONS (CONTINUED)

Action Description	Cost and CRO Reduction Assumptions used in Calculations
Renewable Diesel (R99) Substitution for Conventional Diesel	• Renewable diesel prices calculated based on \$0.05, \$0.10, and \$0.20 per gallon premiums over conventional diesel (B5) • Fuel heat contents and Scope 1 emissions factors from Argonne's AFLEET tool"
Use Simulator for Code 3 Driver Training	• *This action is applicable to 550 hours of training per year* • *Fire engine fuel use assumed to be 7.5 gallons per hour* • *Electricity use for the simulator is assumed to be neglegible* • *Diesel fuel price assumed to be \$2.61 per gallon* • *Simulator training staff is assumed to be on-duty at the time of training and therefore no additional labor cost is applied* • *Reduced engine maintenance and related costs is likely but has not been quantified*
Upgrade Fire Engine (Quint) for Efficient Model	• *EFD's two (2) Quints use ~6,500 gallons of combined diesel annually.* • *One (1) Quint is estmated to use 3,250 gallons annually.* • *Baseline quinty fuel economy is 2.9 miles per gallon* • *Strategy Quinty fuel economy is assumed to be 5.8 MPG* • *Maintenance costs assumed to be the same for Baseline and Strategy* • *Capital costs for new Quint assumed at \$700,000* • *Sale of existing Quint estimated at 10% of new price or \$70,000.* • *Fuel cost savings based on 2016 Eugene fleet data for Quints*
Substitute Electric for Diesel Pump during Hose Training	• *Diesel engine is currently in use for hose training for 280 hours per year* • *75% of hose training could be substituted with electricity* • *Diesel prices are \$2.61 / gallon with an escalation of 2% annually* • *Electricity prices are \$0.07 / kWh with an escalation of 2% annually* • *EFD pumper trucks use 2 gallons of diesel fuel per hour* • *Electric pump lifespan is 15 years*

Net Present Value Assumptions
Energy Escalation Rate: 2%
Maintenance Escalation Rate: 2%
Discount Rate: 3%

APPENDIX C: **DESCRIPTION OF CLIMATE ACTION ASSESSMENT CATEGORIES**

Marginal Capital Costs: This cost represents the marginal difference between the action and business as usual (BAU). For electric vehicles, this plan assumes that a vehicle or equipment purchase will be at the time of natural replacement – therefore the capital cost is the marginal vehicle cost plus development of charging infrastructure.

Marginal Operation and Maintenance Costs: This cost represents the marginal difference between the action and BAU. If the action has existing, equal O&M costs – these costs are not included in the assessment.

Action Lifespan: The anticipated useful life of the equipment or action.

Annual Fossil Fuel Reduction: The estimated reduction in fossil fuel use, primarily gasoline and diesel. BAU fuel purchases include 10% ethanol in gasoline and 20% biodiesel in diesel. Volumes of biofuels are not included in these values.

Annual GHG Reduction: The estimated Scope 1 emissions reduction of carbon dioxide from fossil fuel combustion. BAU fuel purchases include 10% ethanol in gasoline and 20% renewable diesel in diesel. Biogenic carbon dioxide emissions from biofuels are not included in these values.

Cost Effectiveness: Marginal cost or savings compared to BAU divided by metric tonnes of carbon dioxide equivalent reduced over the lifespan of the action. This value is calculated so that City decision-makers can compare the cost effectiveness of Fleet actions to other opportunities in City operations and to market prices for verified carbon offsets. Cost effectiveness is the net present value of costs (discounted at 3%). Annual energy costs and unit prices, based on 2016 data, are escalated at 2% annually.

Timing of Implementation: This is the anticipated implementation time period for specific actions based on operational feasibility and commercially available technologies and products.

Operational Feasibility: Summary of significant operational requirements, benefits or impacts.

Co-Benefits: Summary of significant benefits beyond cost or GHG reductions.